EARLY AID

IN

INJURIES AND ACCIDENTS.

BY

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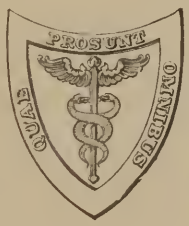
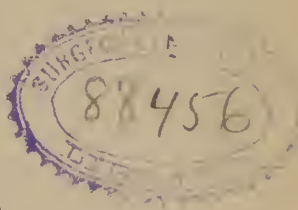
TRANSLATED FROM THE GERMAN

BY

H. R. H. PRINCESS CHRISTIAN.





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TRANSLATOR'S PREFACE.

So much interest has been excited by the Ambulance Lectures delivered all over the country during the last few years, that I feel I need make no apology for publishing this translation of Professor Esmarch's Lectures on the same subject: their excellence and their clearness will suffice to commend them to those interested in this work.

This translation is not in the least degree meant as a substitute for Dr. Shepherd's little handbook; but, having personally attended the Ladies' Classes of the Windsor Centre of the St. John's Ambulance Association, I—and probably others besides myself—felt the want of a more detailed account of the work aimed at than was supplied by notes made at the time: such a want Professor Esmarch's Lectures seemed to supply.

Should any of my fellow-countrywomen who may read this little book be brought to see how each one of us, in her own immediate sphere, may render effectual aid to a suffering fellow-creature, then the object which I have had in view in translating these Lectures will have been attained.

The satisfaction of being able to render the needed aid to those in pain, and of possibly being the means of saving a valued life, should more than counterbalance the scruples that some might feel in entering on such a study.

CUMBERLAND LODGE,
August, 1882.

PREFACE.

THE following Lectures, delivered last winter in my so-called "Samaritan School," are published in the hope and with the trust that many of my colleagues may follow my example, and found similar schools; and because I think that for such a purpose a sort of handbook or guide is desirable.

To make the lectures popular and attractive to those who attended them, I found that large models and diagrams were of the greatest use, and the "Samaritan Society," founded at Kiel on March 5, 1882, has made it one of its duties to reproduce these diagrams. With these and the necessary apparatus for bandaging, etc., the Society will be able to afford substantial aid to Samaritan Schools in other places.

The Society hopes soon to be in a position to offer copies of my diagrams at a reduced charge.

We hope by these means to succeed in spreading this movement all over Germany.

ESMARCH.

KIEL, *March* 14, 1882.

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AMBULANCE LECTURES.

LECTURE I.

INTRODUCTION.

Though I have invited you here to teach you how to render the first aid to the injured, I do not in the least aim at rendering a doctor's services unnecessary; on the contrary, I hope to convince you how important the immediate help of a doctor is in most cases. What I wish to do is to enable you to give the *right kind of aid* before the doctor arrives—without which, irreparable injury might be done, and perhaps even a valuable life be lost.

When I look back on my career as a surgeon, I can with truth say that many and many are the times I have deplored that so very few people know how to render the first aid to those who have suddenly met with some injury. This spe-

cially applies to the field of battle: of the thousands who have flocked thither in their desire to help, so few have understood how to render aid.

But my remark equally applies to the circumstances of daily life. How many there are every year who die a miserable death, and who might have been saved by prompt aid, had any one been near who knew how to give it.

It is a terrible position to stand beside some accident, to see the red blood pouring unceasingly from the wound, to see death every moment approaching nearer and nearer, and not know how to avert the evil.

The desire to help a fellow-creature when injured exists in most of us, but people shrink from giving aid because they do not know how to do so, and are afraid of doing more harm than good.

It therefore fills me with gratification to see so many of you here to-day in answer to my appeal, anxious to learn what should be done to render aid in cases of injury.

You may perhaps know that in forming these classes I am following the example of the English order of St. John of Jerusalem, which for the last

five years has established in England the same kind of schools or classes under the direction of the best surgeons. That already more than 40,000 persons of both sexes have attended these classes all over that country shows the very great interest which they have excited. In England these classes are called "Ambulance Classes," but as a literal translation of this name would be meaningless here, I have preferred calling them "Samaritan Schools," for reasons which I need not explain.

As a member of the Red Cross Society, I have originated this school. There are many among you who have already done service in time of war, and many who, in the event of another war, would be ready to do so again. In these lectures I shall constantly have to refer to the battle-field. I hope and trust that, under the protection of the Red Cross, similar Samaritan Schools may arise all over Germany, and prove of much service in times alike of peace and war.

Before I commence to explain to you how you can give judicious help in injuries and sudden accidents, it is necessary that I should give a short account of the structure and organization of the

human body, as I cannot take it for granted that you have such knowledge; and I trust that my lady listeners will not take fright at the appearance of a skeleton and other parts of the human frame, the sight of which I regret I cannot spare them.

I shall show you in this lecture how the bones form the framework of the whole body; how all movement is produced by the muscles; how all sensations, all emotions and movements are dependent on the nervous system; how the blood is diffused all over the body by the action of the heart; how, by means of the breathing, the oxygen, so necessary to life, is constantly being conveyed to the blood; and how the food which is taken is digested in the stomach and intestines, and ultimately conveyed to the tissues of the body.

Let us commence with the bones.

The Bones.

These form the framework (skeleton), the firm foundation of the body. They are hard, firm, durable; they carry and support the softer and

Fig. 1.

Human Skeleton. Upon the left side of the body the ligaments have been left in place; upon the right side they have been removed. The bones are shown black for the sake of distinction.

more delicate parts of the body; they guard and surround the chief organs of life (brain, spinal marrow, heart, lungs, intestines); they make movement possible by means of the joints and muscles.

The skeleton consists of the following parts:

The Head.

Twenty bones form the skull and face, all tightly knit together, with the exception of the lower jaw, which is movable. The skull encloses and protects the chief organ of life—the brain. The face contains the organs of special sense—eyes (sight), ears (hearing), nose (smelling), tongue (taste).

The Spinal Column

carries the trunk, head, and arms, and contains and protects the spinal marrow (the continuation of the brain). It is composed of twenty-four vertebræ, having interposed between them elastic pads of cartilage which enable the body to bend and turn, and also act as buffers to ward off jars in jumping or falling.

The Chest

is composed of twelve ribs on either side (seven true and five false), which are loosely attached behind to the spine; and of the breast-bone, with which the ribs are connected by means of elastic cartilages. In the cavity of the chest are contained the most important organs of circulation and respiration—the heart and lungs; at its base the cavity of the chest is separated from that of the abdomen by a muscular fleshy partition called the diaphragm.

The Pelvis

is a wide, strong, bony cavity, formed by three large bones—the two haunch-bones and the sacrum or rump-bone. It forms a firm support for the trunk and intestines, and connects the body with the lower limbs by means of very strong but very flexible joints.

The Limbs.

Of these there are two upper and two lower—the arms and the legs. Each upper limb is com-

posed of the collar-bone or clavicle, the scapula or blade-bone, the bone of the upper arm (the humerus), the two bones of the forearm (the radius and ulna); of the hand, which again is made up of twenty-seven small bones, eight for the wrist, five for the hands, and fourteen for the fingers. The upper limbs admit of freer movement than the lower ones, as they are jointed to the shoulder-blade, which is very movable.

Each lower limb consists of the thigh-bone, knee-cap, two leg-bones (the tibia and fibula), and the foot; this latter is again made up of twenty-six small bones, of which seven form the tarsus (heel and instep), five the middle of the foot, and fourteen the toes.

The Joints

are the junction of two bones with each other by means of ligaments. They are at once very firm and very flexible, permitting movement in different directions (*e. g.*, the elbows and shoulders). The joint-ends of the bones are covered with smooth cartilage, whose surfaces rub smoothly

against each other. They are bound together by strong and firm ligaments, and are enclosed in a soft, flexible sac or membrane, the capsule of the joint, which secretes an oily fluid (synovial fluid).

The Muscles

are bundles of reddish fibres, which have the power of contraction—that is to say, they become thicker and shorter in their efforts to approximate the bones between which they are attached (for example, the biceps muscle of the upper arm). When the points of the bones from which they start (the points of attachment) lie far apart, many end in unyielding sinews—a wonderful piece of mechanism, not unlike the lever, bands, and wheels in an elaborate machine. An example of such muscles we have in those of the forearm, whose long, unyielding tendons stretch from above the wrist right down to the ends of the fingers. The great difference is that they do not wear out from constant use, but on the contrary become stronger and stronger, as in the arms of blacksmiths, gymnasts, etc.

The contraction of the muscles takes place

under the influence of the will—an influence which is transmitted to them by the nerves which run alongside the veins between the muscles and send branches into them. But there are also muscles, such as the heart, stomach, and intestines, which contract independently of the will; they act involuntarily.

The Nervous System

is a most complicated, wonderful, and mysterious arrangement, which is ever being studied and investigated by innumerable physicians and men of science, because by it one really first becomes acquainted with many of the conditions of life. The principal parts of the nervous system are the brain, the spinal cord, and the nerves.

The Brain

is enclosed in the cavity of the skull, and consists of a grayish-white, soft, smooth mass formed of nerve tissue. On its surface are seen many tortuous convolutions; its structure is most complicated.

It is the seat of the intellect, the will, and the emotions. All the functions of life are under its

direct control. Hence the striking difference in its size in man and the lower animals according to their intelligence—in human beings it is $\frac{1}{40}$ of the weight of the body, in the elephant $\frac{1}{500}$, and in the whale $\frac{1}{3000}$.

The brain sends nerves to the organs of the special senses; these pass out to the face through holes in the skull (the nerves of smell, hearing, seeing, taste). The principal continuation of the brain is

The Spinal Marrow,

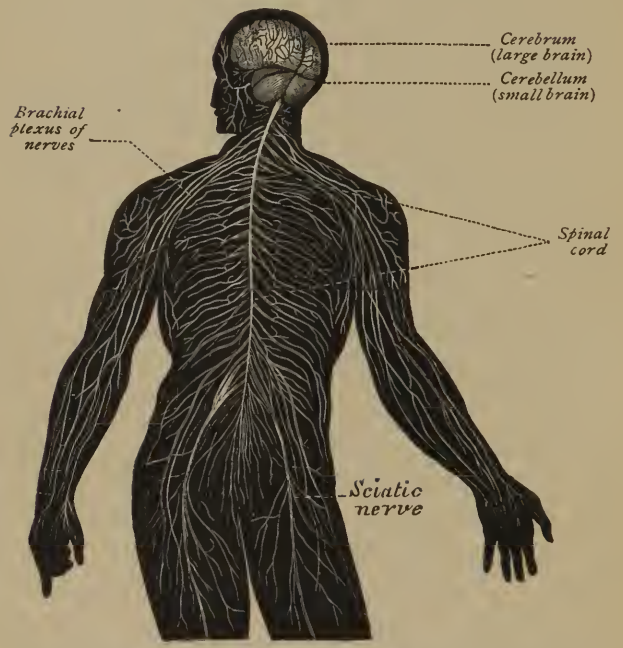
a long cylindrical whitish-gray cord, composed of nerve cells and nerve fibres. It lies in the vertebral canal, in the middle of the spinal column, and gives off from its sides thirty-one pairs of nerves, which go to all parts of the body and preside over movement (anterior roots) and sensation (posterior roots).

The Nerves

are white cords which branch off into ever smaller and smaller filaments, the minutest of which can only be seen through the microscope. They extend all over the body, and are necessary

to movement, sensation, and nutrition. Their roots lie in the brain. The whole system of the

Fig. 2.



View of the Nervous System of Man, showing the Nerve Centres (Brain and Spinal Cord) giving off nerves to supply the whole of the body.

nerves may be compared to a telegraph department—the brain being the chief office, whilst the

sub-offices are found in the spine, and the nerves represent the different wires. The messages come and go with the rapidity of lightning.

After injuries to the brain or effusion of blood into it, there result insensibility, loss of movement, of feeling, of speech. Injuries to the spine cause paralysis of the lower half of the body. Where a nerve has been severed, as by cutting, shooting, or stabbing, loss of feeling (or sensation) and of movement follows. Injuries of the upper part of the spinal cord (the medulla) prove immediately fatal.

The Sympathetic Nervous System.

Besides the nervous system hitherto described there is yet another, which is not subservient to the will, but entirely independent, and which controls the functions of organic life—circulation, respiration, secretion, and excretion. We call it the sympathetic or ganglionic system of nerves. It works steadily on, even when man is asleep or insensible—as in apoplexy, fractures of the skull, and alcoholic poisoning. It consists of a double chain of small nervous centres which lie along the sides of the spinal column. They have nu-

merous knotty swellings or ganglia, and send out numberless delicate branches chiefly to the organs whose actions are not controlled by the will—the heart, lungs, stomach, intestines, etc.

The Circulation.

The red, warm, life-giving fluid which we call the blood is constantly being driven with great rapidity through a wonderful system of tubes or bloodvessels which traverse the whole body. The organ which sets the mass of the blood in motion is

The Heart.

The heart is not the seat of the feelings and emotions, but a most skilfully devised muscular pumping machine. It is a hollow muscular organ with flapping valves within it. It contracts and dilates again in a regular and rhythmical manner. If this movement is arrested, the heart stands still, and death soon follows. It is situated in the left side of the chest; is divided into two halves: the left sends the blood into the body, the right into the lungs. From the left half a tube carries the blood onwards and diffuses it through ever-

decreasing elastic tubes, the arteries, which are named from the different parts of the body to

FIG. 3.

Diagram of the Circulation in Man (and other Mammals).

which they extend. The regular beats of the blood-wave we call the pulse, which is to be felt at different parts of the body—not only at the wrist, but in the upper arm, the neck, the head, the temples, etc.

The arteries break up into smaller and smaller branches, and at last form a thick network of the very finest tubes, $\frac{1}{300}$ of an inch in diameter, and only visible through the microscope. We call them capillaries. They spread everywhere, and give the rosy tint to the skin. If with your finger you press anywhere on the skin, a white spot appears, which by degrees recovers its color: the pressure had driven the blood out of the finest bloodvessels, and it slowly returns to them. Blushing is caused by the sudden rush of blood into these small vessels. Pricks or cuts in the skin open the fine bloodvessels and cause the blood to flow. These minutest vessels reunite into larger ones, and these into still larger, through which the blood returns to the heart. We call these

The Veins.

These are the blue lines which are seen under the skin when the arm is allowed to hang down,

and which quickly disappear when it is raised up high. If a vein is pricked, dark-purple blood wells out in a continuous flow; if an artery is wounded, bright-red blood spurts out in irregular jerks—*i. e.*, with force and rapidity, but with pauses in the flow, because it is driven out by the pumping action of the heart. What causes the difference in the color of the blood proceeding from these two kinds of bloodvessels?

The Blood

is composed of a watery fluid (serum) and little red flat cells (blood corpuscles), each of which measures from $\frac{1}{3000}$ to $\frac{1}{4000}$ of an inch in diameter. The whole mass of the blood of an adult human being contains about sixty billions of these. The blood is necessary for the nourishment and warmth of the body; and the red corpuscles play the chief part in these processes. The dark-red blood contains more carbonic acid, the bright-red more oxygen; so that the bright-red blood on its passage through the smallest vessels must have given off oxygen and taken up carbonic acid. Indeed, there take place in the veins chemical changes which may be compared

to combustion, in which also oxygen is consumed and carbonic acid produced.

When the used-up dark-red blood returns through the bloodvessels to the heart, it must again be purified—*i. e.*, it must get rid of the carbonic acid, and again take in oxygen, by which means it then becomes bright-red. This change is effected in the minute vessels of the lungs, by means of the breathing.

The Lungs

are two soft spongy bags, into and out of which air is pumped by the bellows-movement of the chest. The air enters in by the windpipe; this breaks up like a tree into smaller and smaller branches (Fig. 4), which finally end in innumerable minute air-cells (Fig. 5), over which is spread a network of small bloodvessels which are connected with the right side of the heart.

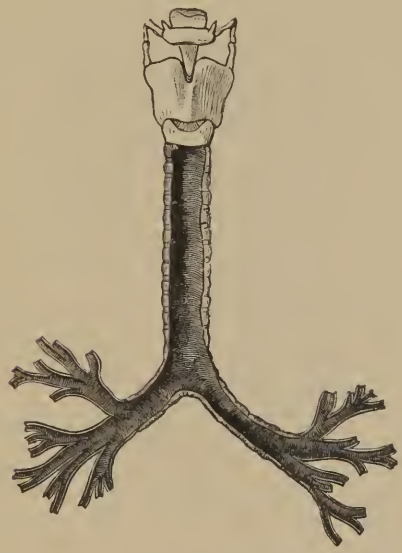
It is from the air which passes into these small cells that the bloodvessels take in their oxygen, and into it that they give out the carbonic acid which exists in the expired air.

The blood, now once again become bright red,

is carried back again to the left side of the heart, to be transmitted afresh to all parts of the body.

The oxygen is the life-giving and nourishing

Fig. 4.



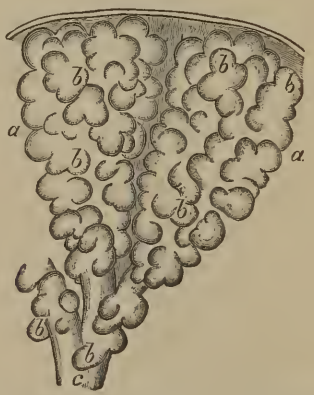
The Larynx (Opening of the Air-tube), Trachea, and Bronchi (Air-tubes. Below the larynx the front of the tube has been removed.

element of the air; the carbonic acid is the product of combustion—the waste material, the ashes: it serves no purpose in nutrition, and must be got rid of. If this exhalation is

stopped, as in spasm of the windpipe and in croup, death soon follows; a like result follows if oxygen is not inhaled.

Besides the carbonic acid, there are other pro-

Fig. 5.



a a, Two small groups of Air-cells. *c*, The ultimate Bronchial Tubes communicating with *b*, the Air-cells. Magnified (Kölliker).

ducts of tissue-change which have to be got rid of, particularly

Water and Urea.

The latter contains the used-up nitrogenous material of the tissues, and is got rid of through the

Kidneys.

These are two smooth, bean-shaped bodies, which are situated in the cavity of the abdomen and on each side of the spinal column. The urine is transmitted from them into the bladder through two long tubes.

But equally important for the excretion of worn-out products is the

Skin.

This covers the whole of the body, and first of all, as a bad conductor of heat, helps to keep up its temperature, to which the layer of fat under it also conduces not a little. In the skin are imbedded numerous sweat-glands (about three millions), which excrete in twenty-four hours nearly as much water as the kidneys (over thirty-five ounces)—about 1000 gr. (= 1 klgr.) in twenty-four hours—partly through perspiration and partly through imperceptible evaporation.

This water also contains no inconsiderable quantity of worn-out tissue products which act as poisons if retained.

The Food

serves to make good to the body the worn-out elements which have been got rid of. For this purpose it must pass through a long thin muscular tube of different diameters—the alimentary canal, in which the various nutrient materials are taken from the food and conveyed into the blood. The food is taken in by the mouth, crushed in it by the teeth, mixed with saliva, and then passes through the gullet and œsophagus, which lies behind the windpipe, into the stomach.

The Stomach

is a large muscular sac, whose walls secrete an acid juice (the gastric juice), which, by means of constant movement, is intimately mixed with the food. This mass, through the constant contraction of the stomach, is pushed into the intestines, and by continuous movement is forced along the whole alimentary canal. In this way the lymphatics, which are situated in the walls of the intestines, take up the nutrient elements of the food, and convey them in the form of chyle to the

blood. This elaboration of the mass of the food is promoted by means of certain juices helpful to digestion: amongst others, the bile, which is formed by the liver, situated on the right side of the body under the false ribs; and the pancreatic juice, formed in a gland (the pancreas—the sweetbread of the lower animals) which is situate behind the stomach. What remains of the food after all the nutrient elements have been extracted passes out of the body.

LECTURE II.

INJURIES.

Contusions (Bruises).

Contusions are injuries caused by falls or blows which have resulted in internal lacerations, particularly of the smallest bloodvessels.

The results are: effusion of blood under the skin, almost immediate painful swelling and discoloration of the injured part (first, blue-red; later, brown-green, etc.) due to the coloring matter of the blood. If, besides the outer skin, important internal organs (brain, spine, lungs, liver, intestines) have suffered, bad symptoms at once become apparent. In concussion of the brain you have fainting, insensibility, vomiting. In injuries to lungs you have blood-spitting: in those to the abdomen, violent pain, sickness, great pallor, fainting, and sometimes sudden death. The liver, spleen, or bowel may be so injured that blood or the contents of the bowel may be effused into the

cavity of the abdomen. In such cases death results very quickly.

What can a non-professional person do in such circumstances?

1. Send at once for the doctor.

2. Loosen all tight articles of clothing.

3. Place the injured person in a comfortable position—with his head low if he look pale or be faint.

4. Sprinkle him with cold water.

5. If the doctor should live at a distance and cannot be got, then carefully transport the patient to him.

Wounds.

These are injuries in which the skin has been severed. They are of various kinds—cuts, stabs, gunshot wounds, contused wounds, etc.

The danger of a wound depends on its depth and size, and, above all, on the importance of the deeper parts involved (veins, arteries, nerves, bones, lungs, heart, brain, intestines, etc.). Stabs and gunshot wounds are generally far more dangerous than from the size of the wound they may appear, because deep-lying important parts are so

often injured by the point of the sword, or by the bullet, and also because portions of a foreign body may have remained in the wound (bits of sword-blade, bullet, bone-splinters, pieces of the clothes).

In injuries caused by machines or by heavy guns, the internal parts injured are generally so crushed and lacerated that death speedily follows. If it is a limb which has been injured, amputation will probably be necessary.

How do wounds heal? In two ways.

I. Quickly, by primary union (union by the first intention) without suppuration, and leaving only a very fine scar. This mode of healing should always be tried for, but can be got only under the following conditions:

1. When the sides of the wound can be accurately brought together.

2. When the sides of the wound are not displaced by bleeding or exudation of matter.

3. When the wound is left quiet and protected from outward injury.

4. When the wound is kept perfectly free from impurity.

II. The second mode of healing takes place slowly, with suppuration, and the formation of granulations, and leaves a large red scar.

This result occurs when the more favorable conditions are absent:

1. When so much skin has been destroyed that the edges of the wound cannot be brought together—as in wounds caused by shells, in scalp wounds, etc.; or when the edges of the wound are so lacerated and bruised that life is destroyed in them.

2. When the edges of the wound are separated by blood or exudation of matter.

3. When the injured parts have been disturbed (the leg, by standing or walking; the hand or the arm, by working; or if the wounded person has been badly transported, which in times of war is often not to be prevented).

4. When the wound was dirty and has not been properly cleaned and disinfected. Want of cleanliness leads to putrefaction and the formation of matter.

It is the matter formed in the process of suppuration which separates the sides of the wounds. When the wound begins to heal, granulations

form, which are often called "proud flesh." These granulations by degrees, and with constant suppuration, fill up the wound, and are finally covered by a large scar, which remains red for a long time.

Suppuration and putrefaction open the door to other dangerous surgical ailments, of which many people die after wounds and operations, especially when the sufferers are collected together in large numbers, as is the case in field hospitals in time of war.

Amongst these dangers are prolonged inflammation and suppuration, surgical fever, erysipelas, hospital gangrene, pyæmia, blood-poisoning, etc. Modern surgery has made wonderful progress in the treatment of wounds, chiefly because a more accurate knowledge of the causes of suppuration and putrefaction has taught us how to prevent these processes and how to guard against many of the dangers to which they give rise.

Before I can answer the question as to how a non-professional person may render aid in cases of wounds, I must endeavor briefly to explain to you

How a Surgeon Treats Wounds.

In all cases he naturally endeavors to bring about that mode of healing which was first described—primary union without the formation of matter.

1. For this purpose—if it can be done—he endeavors to retain the edges of the wound accurately together either by stitches or by a bandage (*not* by means of sticking plaster; this, like most salves and plasters, belongs to the surgery of the middle ages).

But before the wound is closed,

2. All hemorrhage must be stopped. This is generally done by tying the larger arteries which have been cut through: for this purpose sewing silk was formerly used; now we use carbolized catgut, which dissolves in the wound.

3. The injured part must be left perfectly quiet till the process of healing is complete. This is provided for by a carefully-applied bandage, which is generally allowed to remain on till the wound is pretty well healed: formerly, the bandage was renewed every day, or more than once a day. Even after the bandage has been taken off,

the injured limb must be moved as little as possible, lest the wound open afresh, and matter be thus caused to form in it.

4. But the most important thing in the treatment of wounds is the antiseptic means of cleaning them. This should be adopted even in the case of the smallest wound, for it is only by this means that we can prevent suppuration, and so bring about primary union.

The antiseptic treatment consists partly in the practice of the most minute and scrupulous and almost pedantic cleanliness, and partly in the adoption of certain measures which prevent putrefaction by destroying those very minute organisms (germs and bacteria) which are believed to play the chief part in the production of putrefaction.

How terribly dangerous these sources of putrefaction, which exist in all filth and in all putrid and decomposing matter, are to the human organism when they get into the blood, may be gathered from the accounts which so often appear in the newspapers of blood-poisoning from the most trifling wound. You read of some one having pricked his finger or hand with a pin or

a steel pen, and of having died in a few days; or of having been obliged to have his arm amputated because blood-poisoning had set in. In cases like these, you may be sure that some dirt has got into the little wound, either with the pin at the time of the accident, or later by touching some dirty object.

How easily surgeons may be poisoned by such means, and often lose their health or life, is well known.

Amongst those substances which we call antiseptics, or disinfectants, are carbolic acid, salicylic acid, boracic acid, thymol, chloride of zinc, iodoform, naphthalin. With these we clean the wounds and surrounding parts, our fingers and instruments; and in them we dip the different materials, lint, wadding, jute, gauze, etc., which we use in dressing the wound.

But the antiseptic system does not consist solely in the use of antiseptics; it involves also the most scrupulous attention to those principles on which it is founded, and which were first laid down by a distinguished Scotch surgeon, Professor Lister, of Edinburgh (now of London). These principles start with the assumptions (1)

that putrefactive germs are present everywhere, floating in the air, like the motes that one sees in a sunbeam, and constantly settling down on every object, and (2) that every effort must be made to destroy them, and rob them of their virulent properties. To make this beneficial system clearer to you, I will describe the precautionary measures which we now adopt in surgical operations, and how we dress the wound.

When we have to remove a tumor from any part of the body, the patient is first of all placed in a convenient position on a table and rendered insensible by means of chloroform. Meantime, not only the operator, but also his assistants, and all who are in any way engaged in the operation, wash their hands and arms most carefully with soap and brush, and afterwards rinse them thoroughly in carbolic acid water. All the instruments, sponges, and other articles used in the operation, must be thoroughly cleansed and then dipped in the carbolic acid water. Before the operation begins a spray of carbolic acid is formed by means of a spray-producer, and is kept up during the whole period of the operation, even till the bandaging is completed, so that the spray

falls on the patient, the operator, and all the surroundings, and in long operations not unfrequently soaks them. This spray kills all the poisonous germs which are floating about in the air before they can sink into the wound. The part of the body to be operated upon must also be thoroughly cleansed by shaving, brushing with soap, and washing with ether and carbolic solution. When everything that could possibly contaminate the wound has been removed, the operation is performed.

When the tumor has been removed and the hemorrhage been stopped by tying the arteries with carbolized catgut, the whole wound is once more washed out with carbolic acid water. Small tubes (drainage tubes) are introduced in different places, so as to carry off the discharge from the bottom of the wound, and then the wound is carefully sewn up, and dressed. The wound and surrounding parts are covered with a thick pad of some antiseptic material, carbolized wadding, carbolized gauze, etc. A bandage of carbolized gauze is then put firmly round, and over that an elastic bandage, which so compresses the whole that no air can gain access to the wound. This

antiseptic dressing generally remains untouched from eight to fourteen days, according to the size of the wound, and when it is removed one generally finds the wound entirely healed by primary union. In general also the patient has during the whole time experienced no pain, and had no fever; nor has the wound suppurated, and he has thereby happily escaped all the dangers which suppuration brings with it.

The bad odors which formerly pervaded sick rooms and hospitals, and which were produced by decomposing matter, occur now only in those exceptional cases which cannot be treated antiseptically from the beginning.

Now that I have shown you with what care and precaution we surgeons try to ward off all noxious influences from a fresh wound, you will readily understand my answering the question, "How is a non-professional person to render aid to the wounded?" by saying, He must before all things adopt that great principle which surgeons consider the most important—"only do no harm."

How dangerous any impurity is to a wound I have already explained to you. No lint or sticking-plaster or sponges which have been already

used, or soiled linen, must be brought in contact with it, nor must wounds be touched with dirty fingers.

If any dirt (sand, earth, or mud) has entered it, the wound and the surrounding parts ought to be carefully washed or rinsed, but only with clean water and clean linen (pocket-handkerchief, towel, napkin, etc.). Quite clean water, or sea and river water may be used, but water which has once been boiled is safer, as poisonous germs are destroyed by boiling. It is best to mix some disinfectant with the water, and I would venture to express the hope that in every house there should be kept a bottle of some antiseptic solution (carbolic acid, salicylic acid, boracic acid), which may readily be got from any chemist.[1]

If a compress of clean linen soaked in an antiseptic fluid is laid on a wound, till the arrival of the doctor or surgeon, one is quite sure at any rate of having done no harm.

If no surgeon is near at hand, and the wounded person has to be transported to him, it then becomes necessary to fasten this provisional dress-

[1] Strong carbolic acid, it must be noted, is a dangerous thing to have lying about a house: it is a potent poison.

ing on to the wound by a handkerchief or scarf, and at the same time to support the wounded limb well. How to do this I will show you later, when we discuss the subject of bandaging; I will also later on explain to you what should be done in cases of violent bleeding.

If the wound is covered with a layer of clotted blood, do not remove or wash it off, for by disturbing it the bleeding may be started off again.

In time of war every soldier carries with him a little packet of dressing, by means of which he can bind up his own wound or that of his comrade when no surgeon is at hand. This packet unfortunately contains, besides a three-cornered handkerchief, some charpie: it is to be hoped that in case of war this latter will be replaced by some more useful and antiseptic substance. Many attempts have been made to render these "bandage packets" as compact and useful as possible. I have myself arranged one for that purpose, and it contains besides the three-cornered handkerchief two antiseptic balls, made with chloride of zinc, to be laid on the wound, and a gauze bandage with which to secure them. As a great many different kinds of bandaging can be

done by a three-cornered handkerchief, and as such a handkerchief can be got almost anywhere, you shall be shown how to use it when I come to the subject of bandaging. I wish to observe beforehand that bandages are generally used for the following purposes:

1. As a *protection* against external agencies, such as dirt, dust, the heat of the sun, insects, etc.

2. To cause *pressure* (to press the sides of a wound together; to prevent and stop hemorrhage, etc.).

3. To give *rest* and *support* (to support the injured parts, as by a sling; or to bind them to splints, or to the body; and to quiet the muscles, etc.).

Hemorrhage.

Every wound bleeds, because in every wound bloodvessels are injured.

But the kind of hemorrhage, as well as its danger, varies with the size and nature of the bloodvessels which have been injured. If the blood does not flow freely, but trickles gently from the wound, only small bloodvessels (capillaries) have been divided. When dark blood

wells out in a steady stream, and when the flow is increased by pressure applied *above* the wound, then a large vein has been opened.

When bright-red blood spirts out of the wound forcibly and in jerks, an artery has been wounded and danger to life is great.

Unimportant hemorrhages from the smallest arteries or from veins may be arrested by pressure on the wound itself, or by pressing the sides of the wound against each other; or it may stop of itself, because the mouths of the injured vessels contract and the blood in the wound coagulates into a viscid tough mass. Hemorrhage from an injured vein (as from the giving way of a varicose vein in the leg) is sometimes difficult to stop on account of the pressure of some tight article of dress (a garter, for instance) above the bleeding point. On loosening this, slight pressure and elevation of the limb suffice to arrest the bleeding.

Should, however, bright-red blood continue to flow in spite of pressure over the wound, a large artery must have been wounded, and death from loss of blood is to be apprehended.

In such cases prompt aid is necessary. The surgeon should at once be sent for, or the patient

be transported to him. The surgeon will stop the hemorrhage by tying the artery.

But as the patient may die before the arrival of the surgeon, those around should endeavor to stop the flow of blood. The only efficacious way of doing this is by firm pressure on the wound itself if it be small, or on the trunk of the artery above the wound. The injured limb should be raised, as this lessens the flow of blood, and the clothes should be cut away from round the wound. Then a folded piece of linen or pocket-handkerchief should be laid on the wound and fastened firmly on by means of a bandage or handkerchief. If in spite of these means the blood still continues to flow, one must try to find the trunk of the artery between the heart and the wound and press it firmly with the fingers.

In some parts of the body the arteries lie so near the surface that they can be effectually compressed by the finger, and these it is well to know. In the *upper arm* the artery lies on the inner side of the arm in a line with the seam on the coat sleeve; one can compress this artery by placing a thick stick between the arm and chest and tying the arm tightly to the body (Fig. 7), or

Fig. 6.

Fig. 8.

Compressing the Artery of the Thigh.

Fig. 7.

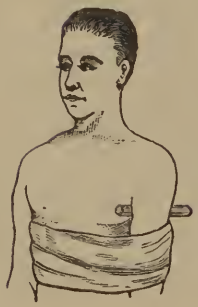


Fig. 9.

Compressing the Artery going to the Head and Face.

by pressing the artery against the bone with the thumb, as in Fig. 6.

In the upper part of the thigh the artery lies in front, just at the middle of the groin (Fig. 8).

The flow of blood through the artery of the neck may be arrested by pressure applied at the root of the neck immediately above the collar-bone and to one side of the windpipe (Fig. 9).

It is at these points that a surgeon generally applies pressure (as with a tourniquet) when he wishes to stop hemorrhage; it is at the same points that he cuts down on the arteries when he wishes to tie them.

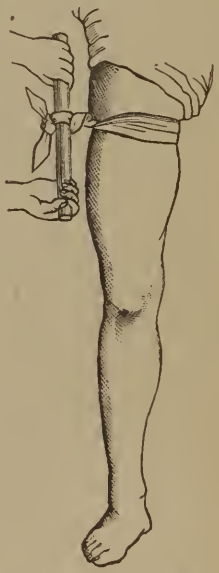
But to stop hemorrhage by pressure applied at a particular point we must have, on the one hand, a certain amount of anatomical knowledge of the part, and, on the other, a certain amount of practice and handiness, as well as strength and perseverance, if surgical aid is long in arriving. Very often in transporting a patient the best-applied tourniquet or compress may shift a little; it then does more harm than good.

It is, therefore, much simpler and safer to use an elastic bandage made of India-rubber (either flat or tubular), by means of which the limb is

bound up so tightly that blood can no longer flow through its vessels. If an elastic bandage be put (no matter how tightly) only once round a limb, the pressure will not suffice completely to compress the bloodvessels; but if it be bound several times round at the same point, every turn so in-

Fig. 10.

Fig. 11.



creases the pressure that in a short time no more blood can pass (Fig. 10). The newest kinds of compresses for arteries with which ambulance

carriages for troops, surgeons' instrument cases, etc., are provided, consist now merely of a flat or tubular India-rubber bandage. But if one of these be not at hand, then other means must be used. For instance, if you have a linen bandage you should bind it round as tightly as possible at one point, being careful that every turn in the bandage covers the former one. When the end of the bandage is well fastened, it should have water freely poured over it. The wet causes the bandage to shrink so much that the pressure thus induced suffices in many cases to stop the hemorrhage.

If you have nothing by you but a handkerchief, you should fold it together like a cravat, put it loosely round the limb, tie the ends together, shove a short stick under it (a walking-stick, door-key, branch of a tree, a sword in its sheath, or a ramrod, will do) and twist this round and round till the bleeding stops (Fig. 11). But an elastic bandage is in all cases to be preferred, as its effect is greater and more lasting.

For this purpose I have recently had an India-rubber brace made, consisting of one piece, and so long that by means of it you can compress the

artery in the thigh of the strongest man. It would be well if those who wear braces were to have them made of this material; they could then use them to arrest hemorrhage from the legs or arms either in themselves or others. If such a belt were worn by every soldier in time of war, difficulty in cases of hemorrhage on a battle-field would seldom occur. For other men too—especially travellers, sportsmen, those who work in manufactories, railway guards, policemen, etc. —it would be a desirable thing to wear them, as anyone may some time or other be placed in circumstances in which such a belt would be of service to himself or others.

When the hemorrhage has been stopped, then the wound must be dressed and bandaged in the manner already explained.

Above all things I must earnestly warn you against using those remedies for stopping hemorrhage which are so often stuffed into bleeding wounds—both those got from the chemist, such as perchloride of iron, yellow charpie, etc., and more popular remedies, such as spider's web. It is possible by such means to arrest trifling hemorrhages, but properly-applied pressure attains

this end much better, and after what I have told you of the danger of letting any impurity come in contact with a wound, you will easily understand that such means are generally hurtful, and must in any case prevent the speedy healing of a wound by *primary* union.

You find these styptics in some of the small packets used in giving "first aid," but from their presence you may know that such packets have been put together by inexperienced persons.

Poisoned Wounds

are caused by the bites of mad dogs, poisonous snakes, and by poisoned arrows and spears. The danger of these is, that the poison from the wound may by means of the lymphatics be carried to the heart and so poison the whole blood.

To prevent this diffusion of the poison, you should, without loss of time, bind the limb round tightly above the wound (Fig. 12); this is best done with an elastic belt or a strap, or string, or a handkerchief made tight by means of a stick twisted round in it. When this has been done, you should try to get rid of the poison from the

wound. This may be done by sucking it out (if the lips be not sore), by burning with hot coal, hot knife or knitting-pin, or by caustic (carbolic acid, nitric acid, etc.). In cases of snake-bite ammonia is used externally, and brandy or other stimulant is also given internally. Send at once for the doctor, and if the wound has been caused by the bite of a dog, shut up and watch the suspected animal. If you destroy a dog supposed to be mad, the wounded individual will always be in fear of hydrophobia, whereas by preserving the animal time may prove that he is not mad, and the patient be thus relieved from his fears.

Fig. 12.

LECTURE III.

FRACTURES.

Bones are hard but brittle, and break like glass or porcelain by outward force (blow, fall, jump, etc.), often with a snap or crack which may be heard and felt.

Fractures are divided into two kinds—simple and compound. We call a fracture *simple* when the skin is not injured. We call it *compound* when it is accompanied by a wound, caused either by the same force which produced the fracture (a bullet, for instance) or by the ends of the broken bone protruding through the skin.

For instance, a man may fall from a tree and break the lower part of his thigh, and the broken end of the bone may be driven through the skin and into the ground.

Compound fractures are much more dangerous than simple ones, because the skin and muscles are always much bruised at the same time, and

because dirt may get into the wound and be with difficulty removed.

How do we know when a bone is broken?

1. The limb is bent or shortened.

2. There is an unnatural degree of movement at the seat of the fracture.

3. There is violent pain.

4. When the limb is moved, the broken ends of the bones may be felt grating against each other.

How does a fracture heal?

New bone-substance (callus) is formed at the broken ends of the bone, and knits them together. This new substance is at first soft, but hardens gradually into bone. The time necessary for the completion of this process varies from two to six weeks, according to the size and strength of the bone. If during this time the broken ends of the bone have remained perfectly quiet in their proper position, the bone joins so perfectly as to leave no outward sign of the injury. If this has not been the case, the bone joins crookedly, or is shortened; or it may perhaps retain mobility at the injured place, forming what we call a "false joint."

How does the surgeon assist the healing process?

1. He sets the fracture: *i. e.*, by means of pulling and manipulation, he brings the broken ends of the bone into their proper position. The pulling he may allow his assistants to do, but the manipulation he does with his own hands.

2. He then adopts measures to keep the broken ends of the bone fixed in their right position till the fracture has healed. This perfect rest he attains either by means of splints (made of wood, tin, pasteboard, etc.), which keep the limb extended, and which are secured by bandages or handkerchiefs; or by some material such as plaster of Paris, starch, etc., which stiffens round the limb and forms a sort of casing.

What can one do in a case of fracture when no surgeon is at hand, and when the patient has to be removed to a hospital or to a doctor?

He can put on a temporary bandage so that the *simple* fracture shall not become compound through the risks attendant on removal, and thereby lessen also the sufferings of the injured person.

In a case of injury, it is necessary to see

whether there are broken bones or not. Often this can be at once discovered through the clothes by the altered appearance of a limb.

If not, the clothes and boots must be cut off—*not* pulled off. When a fracture has been discovered, one must look about for material to use as splints, and for means with which to fasten them on.

Here one must reflect calmly what is to be done, and in thinking of what material can be used for splints the locality in which the accident has happened should be considered.

1. If in a town or near an inhabited locality, one endeavors to procure boards—very thin boards—cigar-boxes (they can be cut or sawn in two), laths, broomsticks, yard measures, pasteboard (books, journals, hat-boxes, etc.), felt (old hats), foot-mats, baskets, etc. From the kitchen, cooking spoons, tongs, shovels, etc., can be got.

From the bystanders one begs for their walking-sticks, umbrellas, parasols.

2. If the accident has happened out in the country or in a wood, one can find branches, twigs, barks, reeds and straw, bits of fencing and paling: and can make pads out of coat sleeves or

shirt sleeves, stockings, etc., stuffed with grass, hay, and straw.

3. On the field of battle, one utilizes muskets, bayonets, their scabbards, lances, leather and felt from saddles, stirrups, telegraph wire. For padding one uses wool, cotton wool, flannel, tow, flax, jute, hay, moss.

Fig. 13.

For fastening the splints, we may use binders (children's binders), pocket-handkerchiefs, neck-handkerchiefs, stockings, sheets, cord, garters, etc., as well as the clothing which has been cut off from the injured person—for instance, the boot which has been cut up, as a foot rest; on battle-fields one can find for this purpose straps of all descriptions (stirrup-leather, etc.).

After having put splints on and bandaged the injured person with the means you have found, the next thing is to get ready a stretcher, or to procure a carriage, on which to place the patient,

and then transport him carefully to where he can get surgical aid.

DISLOCATIONS.

Continued displacement of the articulations of a joint after the ligaments have been torn is called a dislocation: it is the result of outward violence (*i. e.*, a fall, wrestling, etc.), which has caused the joint to assume a direction for which its movements were not intended.

How does one recognize a dislocation?

1. By the altered appearance of the joint—generally very apparent when one compares the corresponding joint of the other side.
2. The mobility of the joint is lessened.
3. Efforts to move the joint cause much pain.

Treatment.

The joint must promptly be replaced in its normal position; but this must be done only by the surgeon.

One must not try any experiments, but wait quietly till the surgeon comes, or transport the patient carefully to him.

SPRAINS.

Sprains are injuries resulting from the twisting and tearing of joint-ligaments, and crushing of the joints through outward violence (through a fall, blow, etc.). The joint shows no distinct alteration in its appearance (compare it with the corresponding joint), but it swells very quickly—all movement becoming difficult and painful.

Treatment.

Keep the injured part perfectly quiet till the doctor arrives—only perhaps putting on cold compresses, by means of wet cloths or handkerchiefs; or transport the patient carefully to the doctor.

Rubbing and "massage" of the joint are often of great use, but only when prescribed by the doctor. The so-called "bone-setters" often understand this treatment well, but not unfrequently also do great harm.

BURNS

are caused by the concentrated heat of fire, or of chemical agents, directly applied to the surface and destroying the skin and tissues underneath.

Boiling liquids or steam produce scalds.

Strong caustics, such as oil of vitriol or caustic potassa, produce "eschars."

In their results these three different kinds of burns are much the same.

We recognize three degrees of burning, according to its intensity.

1. Mere painful redness (superficial inflammation).

2. The formation of blisters.

3. Charring.

Amongst the many causes of accident by fire I will mention only those which nowadays most frequently occur, and which ought to warn us all to carefulness.

Besides fires at theatres, which claim such hosts of victims, we have gas explosions, which are generally due to carelessness in not turning the gas off. We have burning by petroleum, which is generally attributable either to its improper use, or to careless handling of petroleum lamps.

In general, women are more careless about fire than men. How often are the light clothes of ladies set on fire by the careless handling of lighted candles, lamps, etc.

Almost every day the newspapers tell us of

fires caused by children who have been allowed to play with matches; and how often, too, it happens that a careless mother or maid-servant places a jug of boiling milk or soup in such a way that little children, seizing it, pour the contents over their faces, necks, breasts, and arms. These cases, alas! come too frequently under our notice in the hospitals, where we have to operate on the disfiguring scars caused by these injuries.

How many such accidents could be prevented if everyone who was a witness of such gross carelessness considered it his duty to impress the necessity of proper care.

But many, alas! remain silent and go their own way, like the Priest and the Levite, and excuse themselves by saying, "What does it concern me? Let everyone take care of himself."

Let everyone beware of leaving matches or jugs containing boiling fluids within reach of children.

It would be well if the light material of which ladies' ball-dresses are made, and that used for curtains, etc., were to be rendered incombustible. This process is simple and inexpensive, and the color of the material is not impaired by it.

Everyone should know that it suffices to dip these materials in a preparation of sulphate of ammonia, and then to dry and iron them; should they then come into contact with a flame, they do not blaze, but smoulder slowly, like tinder.

What can be done when a woman's clothing has caught fire?

Flames envelop the unhappy creature, scorch her arms and hands, her neck and face: her hair and cap blaze up. The best thing she could do would be to throw herself on the ground and roll about there, and thus by pressure extinguish the flames. Unfortunately, she seldom has the presence of mind to do this, but rushes about screaming loudly: the draught increases the flames, and she becomes a moving pillar of fire.

What should then be done?

One should not rush off to fetch water, but seize upon the first available rug or even tear off one's own coat, wrap it round her and, throwing her on the ground, roll her about there till the flames are put out.

Only then should one fetch water—a great deal of water—and drench her with it, as the smouldering clothes continue to burn into the flesh.

In scalding by boiling water or steam (boiler explosions) cold water should be plentifully poured over the person and clothes. The injured person should then be carried carefully to a warm room, laid on the floor on a carpet, or on a table, but not put into bed (as there it becomes difficult to attend further to the injuries), and then send at once for the doctor.

If the patient complains of thirst, a warm stimulating drink should be given (such as tea), as after severe burning the temperature of the body immediately begins to fall.

The clothes must next be removed, and this is to be done with the greatest care and caution. For this purpose you should, if possible, have the help of two people: the one should be on the side of the patient opposite to that on which you are standing, whilst the second should hand the necessary things. All bystanders should be asked to leave the room.

You should then get a good large pair of scissors or a sharp knife, and carefully cut through the clothing in such a manner that it falls off of itself. Nothing should be removed by pulling or tearing, as that would break the blisters.

On no account, through false economy, try to save any part of the clothing.

Should any of it adhere to the skin you must leave it, only cutting round it with a sharp knife or scissors. Sawing slowly through the clothes with a blunt knife causes immense suffering. Above all, do not break any of the blisters, as by so doing the raw surface would be exposed, but when the blisters are very large, one may prick them with a needle so as to let the fluid run out. If no doctor has yet arrived, the next thing to be done is to protect the burnt surface from the air.

Compresses of cold water generally increase the suffering. A covering of grease, oil, or some dry substance is far more soothing, and generally alleviates the pain more rapidly.

You should therefore anoint the wound well with oil (lamp-oil, salad-oil, castor-oil, or any at hand); or paint it over with grease, lard, butter, etc.; or powder it with flour, starch, powdered charcoal, etc.; or wrap it round carefully in clean soft wadding from which the outer covering has been removed.

If there should be a chemist near at hand, send for a liniment composed of equal parts of linseed-

oil and lime water,[1] and put this on the wound, covering it over with wadding or rags of fine linen. In changing these rags great care should be taken not to cause unnecessary pain.

The antiseptic treatment which I described to you in my lecture on wounds has of late been used for burns with the happiest results.

The matter which is very freely given off from burnt surfaces soon emits a very offensive odor, which is not only distressing to the patient, but also exposes him to the dangers attendant on suppuration which have already been described.

It is therefore necessary to mix an antiseptic substance with the remedies applied—*e. g.*, add carbolic acid or thymol to the oil used, or apply it afterwards, if not at hand at the moment. Or this may be left until the arrival of the doctor. These antiseptic remedies, particularly thymol, not only prevent the bad odor from the suppuration, but tend also to alleviate the suffering. It is therefore much to be desired that chemists should always keep ready mixed an ointment for burns containing one per cent. of thymol.

[1] Called in this country "Carron oil," from its having been first largely used at the Carron Ironworks in the treatment of burns from molten iron, which so frequently occur in such works.

After very extensive burns and scalds the patients (particularly children) are often very quiet, experience little pain, only occasionally sighing and asking for water to drink; this generally is a sign of approaching death. Sometimes death can be warded off even in these cases by hot baths and the injection of human blood into the veins; but for this purpose medical aid must be very quickly got.

Should anyone have fallen into a lime-kiln or soap lye, he should be drawn out as quickly as possible, have water plentifully thrown over him, or be thrown into water, so as to get rid of the lime. The caustic action of the lime or soap lye is best counteracted by some acid—by washing the injured part with vinegar and water or diluted sulphuric acid; then oil should be applied as in the case of ordinary burns.

Should anyone have had acids poured over him (sulphuric acid, nitric acid, vitriol, etc.), it is necessary, besides washing the injured parts freely with water, to use whatever alkali may be at hand—*e. g.*, soda, lime-water (which can be made by dissolving a piece of mortar or plaster in water).

LECTURE IV.

FROSTBITE.

Though this accident is most apt to occur when the degree of cold is intense, it may also happen when the cold is by no means severe, especially if the person exposed is exhausted by long marching or by hunger, or is stupefied by drink, especially if under such circumstances he sits down to rest when a cold wind is blowing.

If snow is falling heavily at the same time, it is in his favor, for snow is a bad conductor of heat, and those who have been snowed up are more easily resuscitated from the effects of the cold than others who have not been protected by the snow. In those who are frozen the whole surface of the body becomes white and cold, with a bluish tint on the nose, lips, hands, and feet. The limbs become stiff, and the extreme points of the body—nose, ears, fingers, toes, arms, legs —are often frozen hard and are as cold as ice.

Endeavors to restore life should be made with

the greatest care. If you bring the patient suddenly into a warm room, death follows most certainly. He should be carried carefully into a closed but cold room, and undressed with care for fear of breaking the stiffened limbs.

If snow is to be had, cover and vigorously rub the whole body with it. If not, cover and rub the patient with cold wet cloths, cold sand, or put him into a cold bath. Alternately with this, one should try artificial means to restore the breathing (as in cases of drowning). If the patient begins to breathe naturally, and the limbs become less stiff, he should be carried into a moderately warm room and covered lightly over with cold coverings and sheets. After this he may only be rubbed by degrees with warm cloths, and the warmth of the room gradually increased.

Then we should try by means of smelling-salts, ammonia, ether, etc., and slightly stimulating drinks, such as light cold wine, cold coffee or soup, to recall consciousness.

Should any part of the body remain without sensation, blue, swollen, or blistered, then there is great danger of mortification setting in. By bandaging and raising the body this danger can sometimes still be averted.

DROWNING.

Everyone should consider it his duty to learn to swim, not only to save himself, but to be able to render assistance to others who are in danger of drowning. If a person who has not learnt to swim falls into the water, he can save himself from drowning, first, by keeping his mouth upwards; secondly, by keeping his lungs well filled with air (by long inspirations and short expirations); and thirdly, by not raising his arms out of the water. As this is not generally known, I will prove it to you by the following experiment on this doll. As long as its arms are under water the mouth remains, as you see, above it; but no sooner are the arms raised than the mouth sinks under the surface of the water.

I have known several cases in which women and even children who could not swim, and who had got out of their depth whilst bathing, saved themselves in this manner.

It results from the fact that a human body is a little lighter than a quantity of water its own bulk; in other words, it is lighter than the amount of water which it displaces when im-

mersed. If the arms should be raised, as when calling for help, then it follows that the head must necessarily sink so much deeper.

It is, therefore, very desirable that all who learn to swim should first learn how to float on the water without making any exertion. This can easily be practised and learnt in fresh water. If the arms are stretched out behind the head, the body takes a horizontal position, and the face and mouth remain above water.

If the arms are stretched out backwards, the weight of the upper and lower part of the body is pretty evenly balanced.

If, however, the arms are kept close to the body, the lower part becomes heavier, the feet sink down, and the body assumes a more upright position. To keep the mouth above water in this position, the head must be thrown right back, which for any length of time is very fatiguing. But every swimmer knows that in this position a very slight movement of the hands and feet suffices to keep the head above water.

When a man falls into the water, either from the shore or out of a boat, and there is no swimmer at hand to rescue him, it suffices generally to

reach him an oar or a rope, because a drowning person generally rises once again to the surface before becoming suffocated, and then, as the proverb says, "catches at every straw."

If, however, there is nothing of the sort at hand, one should pull off his coat, and holding it by one sleeve throw the other or the coat-tails to the drowning person, thereby establishing a communication with him.

An old ship's captain told me that he had saved many lives in this way.

When a person has broken through thin or rotten ice, and cannot extricate himself on account of the edges of it constantly breaking away, it is well known that the best means of helping him is to throw him a long ladder, board, or pole, because by this means the weight is distributed over a larger surface. It is a good plan, too, to attach a skittle-ball to a long cord by means of an iron hook and roll it to the person in distress, so that he may hold on by it till further help comes.

Death through drowning results from two causes.

1. Generally from suffocation, when water in-

stead of air enters the lungs. A person who dies in this way, fights long against death, and presents the appearance of having been suffocated; the face is swollen and purple, the lips are livid, and the eyes are bloodshot, there is much water in the stomach, and the mouth, windpipe, and lungs contain a frothy fluid.

2. More rarely faintness ensues immediately, *i. e.*, the heart-beats and respiration cease, the entrance to the windpipe is closed spasmodically, so that but little water can get into the lungs. The face of the drowned person is pale and flabby, and there is but little frothy fluid in the mouth. In this case restoration to life is more hopeful than in the previous one.

As life may not be extinct even after hours spent in the water, it is well to consider all drowned persons as only apparently dead. Indeed, life has not unfrequently been restored after long hours of unceasing efforts.

The efforts to restore life must be carried out with quietness, caution, perseverance, and continuous energy. The following rules will be found applicable.

1. Send at once for the doctor, and at the same time for sheets and dry clothing.

2. Efforts to restore life should at once be resorted to energetically, and if possible in the open air, except in very bad weather, great cold, heavy rain, etc.

3. The first and most urgent task is to restore respiration. With the exception of removing the wet clothes and drying the skin, no efforts to restore the circulation and the warmth of the body should be made till respiration has been established, otherwise the result may be imperilled.

4. The efforts to restore life must be continued uninterruptedly until the arrival of medical aid, or till respiration and the action of the heart (pulse) have ceased for hours.

5. The drowned person should not be placed head downwards, nor lifted up by his legs, but he should be laid on his stomach, supported by rugs or articles of clothing, with one arm under the head, and the head lying rather lower than the body, in which position the water collected in his mouth is got rid of.

6. In order that the air may have free ingress to the windpipe, the mouth should be opened,

and all mud, etc., removed from it and from the nostrils with a pocket-handkerchief; the tongue should be drawn forward, and kept in that position (an elastic band over the tongue and under the chin will do this best), and the jaw pushed forward.

7. The wet clothes must be got rid of; and, first of all, all tight clothing about the neck and chest (neck-handkerchief, shirt-studs, braces).

8. To excite natural respiration, snuff or smelling-salts should be applied to the nostrils, or the throat tickled with a feather; rub the chest and face briskly, and dash hot and cold water alternately on them, or beat the chest with a wet towel.

9. If these efforts prove fruitless, one should not waste too much time over them, but at once proceed to artificial respiration.

Artificial Respiration.

10. The object of this is to cause the chest alternately to expand and contract, so that fresh air may penetrate into the lungs.

11. These movements may be carried out in

different ways, but Silvester's method is the best —and I would strongly recommend it, because I have seen the best results from it in my own hospital; and also because, should necessity arise, it may be put in practice by one person alone, in the following manner:

FIG. 14.

Inspiration (Silvester's method).

12. Place the apparently dead person flat on his back, raising his head and shoulders slightly by means of a folded article of dress.

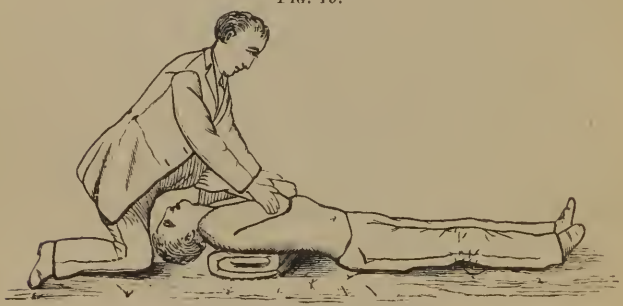
13. Stand behind the patient, grasp his arms just above the elbow, and draw them gently and steadily upwards over the head, keeping them in that position for two seconds; by this means, the

chest expands, and air is drawn into the lungs (Fig. 14).

14. Then carry the arms back again in the same way and press them gently and firmly against the sides of the chest for two seconds; by this means the air is pressed out of the lungs again (Fig. 15).

15. If two persons are at hand to render assistance, then they should stand on either side of the

Fig. 15.



Expiration (Silvester's method).

drowned person; each seizes an arm, and at the word of command, "One, two, three, four," they both simultaneously make these movements.

16. These movements are to be repeated carefully and perseveringly, about fifteen times in a minute, till natural respiration begins. The first

evidence of this is a sudden change in the color of the face (pallor changes to redness, and *vice versâ*).

17. Another method, which, as well as the foregoing, is in use in the English navy—viz., that of Marshall Hall—is also very efficacious, but to my mind not so good as the former. It can only be carried out when several people are at hand to help. The process is the following:

18. Lay the patient with the face downwards, support his chest by folded articles of clothing, and place one arm under the forehead.

19. Whilst the patient is in this position, make uniform but efficient pressure by means of the hand on the back, between or on the shoulder-blades, so as to press the air out of the lungs.

20. Turn the body carefully on the side and a little beyond, and then briskly on the face back again.

21. These measures should be repeated fifteen times in a minute (counting slowly up to four each time), first to the one side and then to the other, one of the assistants meanwhile supporting the head and arms. By placing the patient on the chest the weight of the body forces out the air;

when replaced on his back, the chest expands and air is drawn in.

As soon as a spontaneous effort to breathe is produced by either of these measures, leave them off and endeavor to restore the circulation and warmth.

22. Wrap the body in dry blankets and commence rubbing the limbs upwards firmly and energetically under the blanket or over warm articles of clothing, which can generally be got from the bystanders.

23. The patient should then, if possible, be put into a warm bed, covered over with hot flannels. Bottles or bladders of hot water, or heated bricks. should be applied to the pit of the stomach, in the armpits, between the thighs, and to the soles of the feet.

24. When life has been so far restored that the patient is able to swallow, give him warm fluids by spoonfuls to drink—warm water, tea, coffee, brandy and water, wine—but not in too great quantities. Warm baths should only be used when ordered by the doctor.

SUFFOCATION.

Suffocation is principally caused by inhaling noxious gases, viz., charcoal vapor; coal-gas (the escape of which is due either to faulty pipes or to its not having been turned off); sewer gas (which proceeds from cesspools, soil-pipes, and disused wells): carbonic acid (which is contained in over-crowded rooms, and cellars in which new wine or beer has been placed).

Persons who are in places containing such noxious gases soon become stupefied, the breathing becomes impaired, the pulse stops, they lose consciousness, faint, become convulsed, and die if not speedily rescued.

The first thing to be done in such cases is to bring the unconscious person at once into the fresh air.

But in doing this the person who has gone to the rescue must act with the greatest caution lest he himself should fall a victim to the noxious atmosphere.

Before going into a room filled with charcoal vapor, one must first try to establish a thorough draught by opening the doors, and forcing in the

windows, if possible from the outside (by means of poles and ladders). Should this latter be impossible, the best plan is to cover one's mouth and nose over with a cloth soaked in water, or equal parts of vinegar and water, take a deep breath at the door of the room, rush to the nearest window in it, break a pane, put the head through the aperture, take in fresh breath, rush to the next window, and so on till the through draught has dispersed the vapor, and the unconscious persons can be removed.

If gas has escaped into a room, one must, of course, not enter it with a light, but endeavor to find the window in the dark.

When a man who has gone down into a pit becomes unconscious, it is a proof of the dangerous state of the air in it. (The experiment, so much recommended, of first lowering a lighted candle into such air is not thoroughly to be relied on, for a light continues to burn in sulphuretted hydrogen.) The best thing to do is to send instantly for ladders and ropes, protect the mouth and nose by means of a cloth dipped in vinegar and water, and endeavor to get rid of the poisonous gas (which is generally heavier than the

natural air) by creating a movement and disturbance in it. This may be done by discharging a gun, by throwing down burning straw or paper, by lowering an open umbrella and quickly drawing it up again, and by throwing down quantities of water or lime-water. As sewer gases are sometimes inflammable and explosive, one must be very careful, when throwing burning substances into them, not to get burnt by the sudden bursting forth of flames.

Whoever goes down into a pit to rescue an unconscious person should have a cord fastened firmly round his chest and shoulders, and a signal line attached to one hand. A cloth soaked in vinegar and water should be bound over his mouth. The rope is held tightly stretched from above, while the signal cord is watched by a person specially deputed for that purpose. Should the person who goes down into the pit cease to answer the periodic calls from those above, and no longer use the signal cord, he has probably become faint, and should at once be drawn up.

When he has safely reached the bottom of the pit, he endeavors to find the unconscious person with as little delay as possible, fastens a second

cord (which has also been lowered) round him, and then gives the signal to draw them both up.

As soon as the suffocated person is brought into the fresh air measures to restore life should at once be resorted to: artificial respiration, pouring cold water on him, and using stimulants in the manner already described.

On finding a person who has committed suicide by hanging, we should at once with one hand cut the cord by which he is suspended, while with the other we support the body, so that it may not be injured by falling to the ground. Then the same means of restoration must be used as in ordinary cases of suffocation.

Choking caused by pieces of food—meat, bones, etc.—sticking in the throat, and closing up the windpipe, may cause death very quickly.

In such circumstances the sufferer gets purple in the face, the eyes protrude, he makes inarticulate sounds, throws his arms about or seizes hold of his throat, and fall unconscious on the ground. In these cases one must act promptly, take hold of the nose with the left hand and keep the mouth open; boldly and quickly insert the first

finger and thumb of the right over the tongue deep down into the mouth and endeavor to catch hold of the obstruction and remove it from the throat.

If this does not succeed, try to loosen and force it out by pressing the chest and stomach of the person against a table, cupboard, or other solid pieces of furniture, and give him with the fist several quick, smart blows on the back between the shoulder-blades. The air which is by these means pressed out of the lungs may force the obstruction out of the throat.

Send at once for the doctor, letting him know what is the matter, so that he may bring the necessary instruments with him — forceps, and those required for performing tracheotomy.

LOSS OF CONSCIOUSNESS.

Loss of sensation and of voluntary motion may result from other and very different conditions than from those already described. The chief causes of loss of consciousness are:

1. Injuries to the brain, with or without fractures of the skull.

2. Diseases of the brain, apoplexy, epilepsy, etc.

3. Poisoning by narcotics, opium, morphia, alcohol, ether, and chloroform; and by retention of urine, the result of kidney disease.

4. Fainting, paralysis of the heart through fright, pain, exhaustion, loss of blood, etc.

As it is often very difficult for the best medical man to determine at once with what form of unconsciousness he has to deal, it would be useless for me to tell you how to distinguish between and recognize these conditions. I will, therefore, confine myself to giving a few leading rules for the guidance of a non-professional person till medical aid arrives.

1. Obtain all information possible as to the cause of the accident, whether the injured person has had a fall or blow, been wounded, or has been drinking.

2. Note the position of the body and its surroundings, as the case might possibly be brought before a magistrate, and a minute account of it be required.

3. Observe whether the breath smells of spirits. If this be the case, it shows that he has been drinking. But too much importance is not

to be attached to this; as other and more serious conditions—paralysis, injury to the brain, etc.—may coexist with intoxication. Moreover, the smell of spirits does not necessarily indicate intoxication.

4. Remove all tight clothing from about the neck—neck-tie, collar, shirt-studs, etc.—as these interfere with the flow of blood from the head.

5. Give free access to fresh air round the patient, and send all useless bystanders away.

6. Place the body on the back, with the head low if the face is pale, as in faintness after great loss of blood. If the face, however, is red, the head must be raised. If sickness sets in, the head should at once be turned on one side so that the vomited matters should not be drawn into the lungs.

7. If the patient has an epileptic fit, his body and limbs are convulsed, the face is red and distorted, he foams at the mouth, and the tongue is often caught between the teeth. In such circumstances, do not try to stop the convulsive movements, or to open the clenched hands, for this would only increase the convulsions.

Endeavor only to prevent the patient injuring

himself, place something soft under his head, and put something soft, such as a cork or a pocket-handkerchief, between the teeth, so as to prevent the tongue being bitten, and wait quietly till the attack is over.

8. If the patient no longer breathes, which can be ascertained by holding a looking-glass, or flat piece of metal, or a feather before the mouth and nose, then we should at once have recourse to artificial respiration.

9. Send as quickly as possible for medical aid, or transport the patient to the hospital.

POISONING.

Poisons are substances which, taken internally, destroy life.

They are divided into irritants and narcotics.

1. Examples of irritants we have in arsenic, phosphorus; acids, such as sulphuric, nitric, and carbolic acid; and alkalies, such as soda, lime, caustic potash.

These at once cause violent pain in the stomach and bowels, and sickness.

Acids and alkalies also burn the lips and inside of the mouth.

2. Examples of narcotics we have in opium, morphia, belladonna, hemlock, foxglove, tobacco, alcohol, prussic acid, strychnine. These cause torpor, delirium, insensibility, stertorous breathing.

Treatment of Poisoning.

Endeavor if possible to discover the nature of the poison, send at once to the doctor, and to the nearest chemist, where antidotes are to be procured.

Till help comes, remember that acids and alkalies act as antidotes to and neutralize one another; therefore, if an irritant acid has been swallowed, alkalies dissolved in much water should at once be given, viz., soda, potash, magnesia, lime-water.

If an alkali has been taken, then give acids, viz., vinegar, lemon juice, etc.

To protect the stomach and gullet from the corrosive action of irritant poisons, bland and oily fluids, such as oil, white of egg, milk, flour and water, should be freely administered. To get rid of the poison out of the stomach, try to cause vomiting by tickling the back of the throat

with the finger or a feather, by large draughts of tepid water, with a teaspoonful of salt or mustard; by emetics, if they are at hand, such as ipecacuanha and sulphate of zinc. If the poison taken be a vegetable narcotic, endeavor to keep the patient awake; give him strong black coffee to drink (or injections of strong coffee); put icy cold compresses on the head, and mustard plasters on the stomach and calves of the legs; give douches of cold water.[1]

The doctor will endeavor by means of the stomach-pump to get rid of the poison.

Get, if you can, a piece of gutta-percha tubing an inch in circumference, and if the patient is not unconscious, make him swallow twenty to

[1] The best antidote in poisoning by arsenic is the moist peroxide of iron of the British Pharmacopœia; it may be got from any chemist.

It can be improvised by dissolving half an ounce of sulphate of iron and half an ounce of carbonate of potash (or three-quarters of an ounce of carbonate of soda) separately in a cup of hot water, and mixing the solutions together. If it be at hand, a quarter of an ounce of calcined magnesia may be added. Dilute the soft pasty mixture with half a pint of hot water, and let it be taken as warm as possible.

In phosphorus poisoning give ten drops of oil of turpentine, every quarter of an hour, in gruel or milk, with a little magnesia.

twenty-five inches of it, enough to reach the stomach; raise the free end above his head, and by means of a funnel, pour as much water down as the stomach will receive (Fig. 16), then lower

Fig. 16.

Fig. 17.

the free end below the level of the stomach, and the stomach will empty itself (Fig. 17). Repeat this process several times.

[If the patient cannot swallow, it requires medical skill to pass the tube into the stomach, avoiding the opening into the windpipe.]

LECTURE V.

TRANSPORT.

When an accident occurs—be it in the country, on the high road, or in a town, the first thing to be done is to transport the injured person as quickly and as carefully as possible to a doctor or to a hospital.

The importance of this task is naturally greatly increased in time of war, when large numbers of wounded have to be conveyed from the field of battle, both to the places where the bandaging and dressing are performed, and to the hospital.

In such circumstances stretchers or litters should, if possible, be used.

These are simply light portable beds made of a framework of poles, with a piece of canvas stretched between them.

In time of war each army division is supplied with several bearers, who are provided with simple, light stretchers, and who have been in-

structed by the surgeons how to transport the wounded after they have undergone a temporary dressing.

In very great battles, however, the means provided are insufficient, and the wounded are often obliged to lie for days and nights on the battle-field; volunteer helpers are then much in request, and can be of the greatest use.

It was the thrilling description given by Henry Dunant of the battle-field of Solferino, that led to the formation of the Red Cross Society, a society which has done wonderful service in recent wars.

Among the results of the philanthropic works of the Red Cross Society is the introduction of litters on wheels, first used in 1864 at Düppel by the Knights of St. John of Jerusalem.

A particularly useful one (Figs. 18 and 19) has been invented by Mr. John Furley, Honorary Director of Stores of the St. John's Ambulance Association in England, who has done so much for ambulance work in England, and who has personally most actively represented the Red Cross on most of the battle-fields of recent wars.

These wheeled litters are of service in times of war, if the ground is not too unfavorable; but

they are more useful in cases of accident in every-day life, particularly in large towns, as they may

Fig. 18.

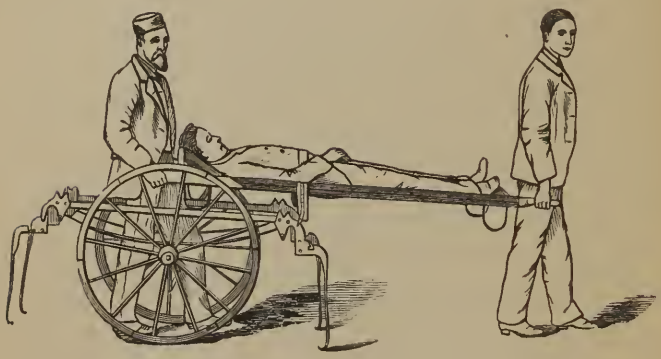
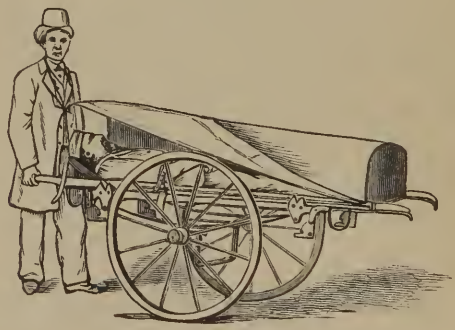


Fig. 19.



be stationed at appointed places (such as railway stations, police stations, fire-brigade stations),

from which they may be easily and rapidly fetched by one person. On flat ground they are the easiest means of transport for the patient.

To place an injured person on a stretcher and convey him properly requires a certain amount of handiness—which is, however, easily acquired by a little practice. Only three bearers are required, unless the distance be very great; two of them carry the stretcher, and the third attends to the patient, and changes places with one of the bearers if necessary.

To place the patient on it, put the foot of the stretcher at his head in a line with his body. If you put it at the side of the patient, it is in the way of the bearers, and they may stumble or fall over it.

The two bearers then place themselves one at either side, join hands underneath the back and hips of the patient, raise him up, lift him backwards over the stretcher, and lower him on to it.

The third bearer takes charge of the injured portion (limb or head), and steadies it with a hand on either side.

The two bearers now take their places at the head and foot of the stretcher, lift it up, and carry

it off; while the third walks at the side of it, as a safeguard to the patient.

The following rules should be observed in carrying a stretcher.

1. It should be carried with the hands, or suspended by straps over the bearer's shoulders.

The stretcher should never be placed on the shoulders, because the bearer cannot then watch the patient, who might fall off, or even die, without the bearer observing it.

2. The bearers should not keep step. If they keep pace, as in marching, the stretcher sways from side to side, and the patient is apt to roll. To prevent this the bearers must walk in broken step, *i. e.*, not to put the same foot forward. Then the motion of the stretcher remains even.

The pace must be short (about 20 inches), and without a spring; the knees must be rather bent, and the hips moved as little as possible.[1]

3. All jolting, hurried movements, the crossing of fences, ditches, etc., are to be avoided. Look out for gaps, gates, and doors, and make use of them.

[1] The Italian boys, with their trays of plaster-of-Paris figures, always walk in this manner.

4. If possible, choose bearers of the same height. If this cannot be done, arrange the shoulder-straps in such a way that the stretcher may be balanced as evenly as possible.

5. In ascending the patient's head must be in front; in descending, behind, except in the case of a broken leg, when, if such a course were adopted, the weight of the body would press on the injured part.

6. The patient must be removed from the stretcher in the same manner in which he was placed on it.

The military ambulance bearers are trained to carry out all these movements by fixed words of command; by this means they acquire wonderful precision and quickness.

Should no stretcher be at hand, one must be improvised—*i. e.*, you must look about for a substitute, or put together a variety of things on which the injured person can be transported without further harm. In constructing such temporary stretchers, each person must exercise his ingenuity as in extemporizing splints. Some people will quickly put a stretcher together out of anything at hand, whilst others remain entirely at a loss what to do.

I will just mention a few examples of such temporary stretchers.

Amongst the articles to be found in inhabited houses which can be used for such, are—bedsteads, bedframes, sofas, window-shutters, boards, benches, chairs, etc. Such hard materials should be covered by pillows, blankets, straw, etc.; mattresses, or sacks of straw, having rings or loops made with straps attached to their four corners, may also be used as stretchers.

Counterpanes, blankets, rugs of all kinds, may be carried by the four corners by four men; or may have two poles sewn to their sides, and be carried by two men. Empty corn or flour sacks may be used for the same purpose.[1]

Hammocks, fastened to one or two poles and carried on the shoulders of two men, are much used in the navy.

With two poles, a variety of different materials can be used for making useful stretchers. Failing these, muskets or lance-staffs lying about on the battle-field can be used in time of war. These

[1] General Jackson, during the war against the American Indians, had his wounded carried on the skins of the slaughtered oxen slung between muskets.

pushed through the coat-sleeves (turned inside out) of two tunics or military cloaks buttoned across them, form a stretcher; folded-up cloaks can also be used.

Sailors can use their oars, boat-hooks, jackets, and jerseys in the same manner and for the same purpose.

Two or three knapsacks, fastened between two poles or muskets by their straps, also form a stretcher.

Girths and straps of all descriptions—belts, saddle-girths, knapsack-straps, musket-straps, bridles, stirrup-straps, such as are found on battle-fields, stretched across two poles like a net, may also be used for this purpose.

A long rope of straw, which the country people are accustomed to plait very rapidly, may also be used. These ropes are plaited with three bundles of smooth straw like a "three plait," which are twisted before each turn. Laid zigzag over two poles kept apart by two cross pieces of wood, having a straw pillow placed on them, they form a very comfortable straw stretcher.

Fascines and gabions, such as are used in trenches, can be turned into stretchers.

From woods and gardens you can take branches and young spruce stems, and binding them together with birch twigs, make excellent temporary stretchers with supports, after the design of the Norwegian surgeon Dr. Christen Smith, who first exhibited one of them at the Exhibition of Hygiene at Brussels in 1874. He covered these stretchers with a three-corner canvas cloth which all Norwegian soldiers carry on their knapsacks.

Fig. 20.

If neither a stretcher nor material out of which to make one can be found, then try to transport the wounded man with your arms, which naturally can only be done for a short distance.

If there is only one person at hand to help, and if the wounded man can walk, though weak from hemorrhage and faintness, then he must put one arm round the neck of the person as-

sisting him, so that his hand hangs down over the further shoulder; the person assisting places his arm from behind round the waist of the wounded man, and with his other hand holds that of the patient hanging over his shoulder (Fig. 20). In this way he can support him very efficiently, and if necessary raise him from the ground, and help him on. Should the patient, however, be unable to stand or walk, then the person helping him can take him either on his back, or, if strong enough, carry him in his arms like a child. In either case the wounded man must place his arms around the neck of the man carrying him.

Should there be two people at hand to render assistance, the wounded man may be transported in a variety of ways, viz.:

1. Sitting on the hands of the bearers, who pass two hands under the thighs and two behind the loins, the patient putting his arms round the necks of those carrying him (Fig. 22).

2. The persons transporting a wounded man join their hands firmly together, forming a sort of sedan chair[1] (Fig. 21), on which they can carry

[1] English children call this a "dandy chair."

him a long distance if he places his arms round their necks.

3. Their task may be made easier, if by means of a belt, a knotted rope, or a straw rope, they make a round seat on which the wounded person is placed, and which is held on either side with one hand by the bearers (Fig. 23).

Fig. 21.

Fig. 22.

Fig. 23.

Stretchers made with muskets and knapsacks can also be carried by two bearers, if the wounded man places his arms round their shoulders or rests his back against the chest of the hindmost bearer.

If the patient be unconscious, one of the bearers must support the upper part of the body, and the other, walking in front, take the legs, one under each arm (Fig. 24).

If an injured person has to be transported to so great a distance that the assistance of many

Fig. 24.

bearers for the stretchers would be necessary, a carriage should be procured, if possible, and the stretcher carefully placed on it, and fastened securely with ropes to the interior.

The Army Ambulance Corps is regularly instructed how to fit up an ordinary wagon for the transport of the wounded by means of straw ropes, etc.

In cases of exigency these wagons are filled with straw, hay, fern, or other soft substances, on which the patient is carefully laid.

A very ingenious method has been devised by Dr. Christen Smith, for adding wooden springs to these wagons for the transport of the wounded.

In winter, when there is snow on the ground, sledges are naturally a much better mode of transport for the wounded than wagons, as they glide smoothly over the snow without any jar.

For the same reason transport by water, in boats, ships, or on rafts, is much to be preferred to transport by road.

If you cannot procure a carriage or wagon, but can only get a horse, mule, or other animal used for drawing weights, then, by means of a long pair of poles or small trees, a sledge can be constructed on which the wounded can be transported in a comparatively easy manner, even on rough ground.

Such sledges are much used in mountainous

districts, and are also used in the plains for transporting heavy weights, such as rock, etc.

During an expedition which I once made with a party on Monte Generoso, between Lugano and Como, one of the ladies had the misfortune to fall with the mule on which she was riding, and to sprain her foot badly. We carried her to a small Italian village and endeavored to procure a stretcher and a carriage. This latter was not to be had, the roads being much too steep and uneven for the passage of such a vehicle. The inhabitants offered us a mountain sledge composed of two long tree stems, the one end of which was borne and drawn by two cows, whilst the other end dragged on the ground. On this a large basket-bed was fastened, well stuffed with bedding, and which held comfortably four of the ladies.

With this conveyance we slowly descended to the shores of the Lake of Como, and though the road was in places really terrible, the drive was a very comfortable one for the ladies, and our patient suffered no pain, owing to the easy motion of the sledge. I was vividly reminded of this adventure during the Russo-Turkish war.

When a Russian lady of high birth asked me whether I could not recommend a means of conveyance for the many wounded who suffered terribly on the bad roads when transported in the wagons provided with square-edged wheels, I recommended her to try such sledges, and heard afterwards that the result had proved highly satisfactory.

I have since been told that in North America Indian tribes use such sledges in their wanderings through the prairies to transport their wives, children, and wounded.

If a wounded person has to be transported by rail, try to place the stretcher—if he be on one—in a compartment. Much help is required for this purpose, particularly if the platform be not high. It is best to place the stretcher lengthways across two seats. If there is no stretcher, make a couch by means of a board laid between the seats. If the stretcher is too broad to pass through the door of a compartment, then place it in a luggage van.

As the springs of these vans are very rough and stiff, and only begin to act when heavily laden, try to procure a spring-couch.

The litters on wheels are provided with excellent springs, and are, therefore, well adapted for transport in luggage vans.

The best means of transport by rail are ambulance carriages made for that purpose, and saloon carriages. This means is, alas! very expensive. Years ago I pointed out that it would be most desirable that the Red Cross Society should have such carriages in readiness, so as to be able to use them whenever required. Hitherto my recommendation has found no response.

In times of war the railroad is very much used for the transport of the sick and wounded; and in the last great war the example of the Americans was followed, and hospital trains, containing everything requisite for the sick and wounded, were provided.

For our own army the plan I proposed in 1867 for utilizing the fourth-class railway carriages on the American principle has been adopted and is well organized. Luggage vans, in which the stretchers are suspended by ropes, are also used.

It is one of the first duties of the Red Cross Society to fit up such hospital trains in time of war, so as to transport the sick and wounded

direct from the battle-field to the hospitals at home.

In concluding my course of Lectures, I thank you all for the attention with which you have listened to me, and for the sympathy you have shown for the object brought before you, at the same time expressing the hope that this work may spread and carry blessings all over Germany.

After each lecture, practical instruction was given in the following modes of rendering aid.

1. The use of the three-cornered handkerchief.

a. Folded together as a neck-handkerchief, for the neck, eye, forehead, ear, cheek, chin, jaw; to fasten on compresses or antiseptic pads on wounds, and to fasten on splints. To support the arm (small sling).

b. Unfolded, in its triangular shape as a sling for the support of the arm.

Head handkerchief bandage.

Handkerchief bandage for chest and back.

Handkerchief bandage for the shoulder.

Handkerchief bandage for the hip.

Handkerchief bandage for the foot.

2. The manner in which to use roller bandages.

Bandaging from below upwards smoothly (without creases) with even pressure (avoiding gaping).

Turns in bandaging—the circular, the rapidly ascending spiral, the slowly ascending spiral (the turns of which partially overlap each other).

Bandaging by reverses (when the circumference of the limb increases).

Figure-of-eight bandage, employed where the bandage passes over a joint.

3. The fixing and fastening on of *splints* (pasteboard), in cases of fractures of limbs.

4. How to stop hemorrhage by compressing the arteries with the fingers, by means of a tourniquet, of the elastic tubing or bandage, and by the "Völkers" tourniquet.[1]

5. *Artificial respiration* in cases of apparent death (Silvester's method).

6. The transport of the injured.

[1] Invention of Professor Völkers, of Kiel.